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# Town of Bennett

## Bennett Future Park – Phase 2

## Project Manual

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**Proposal Number:** RFP 20-001

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# SECTION 02115

# SITE CLEARING

## PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Clearing and grubbing.
   2. Removing above-grade existing improvements to include utilities, as identified or interfering with proposed construction.
   3. Removing below-grade existing improvements to include utilities, as identified or interfering with proposed construction.

B. Related Sections:
   1. Earthwork: Section 02200.

C. Related Documents:
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section, to also include the following:
   2. Geotechnical Engineering Report (not available)

D. The Contractor will remove, wholly or in part and satisfactorily dispose of all foundations, fences, old pavements, abandoned pipelines, and any other obstructions which are not designated or permitted to remain, except for utilities and for those items which other provisions have been made for removal. All salvable material will be clearly marked by the Project Manager and shall be removed, without necessary damage, in sections or pieces which may be readily transported and will be stored in locations approved by the Project Manager. These materials may include, but shall not be limited to, manhole frames and covers, inlet grates, fence material, culverts, walkway, roadway, and parking appurtenances and irrigation systems and appurtenances. The Contractor will be required to replace any materials lost from improper storage methods or damaged by negligence. Removal of sign panel will include all work necessary to remove the panel and its attachment hardware from the existing installation. Concrete adhering to sign posts will be removed; pedestals and bases will be removed to one foot (1') below the surrounding ground or subgrade.

E. Where portions of structures are to be removed, the remaining parts will prepared to fit new construction. The work will be done in accordance with plan details and in such a manner that materials to be left in place will be protected from damage. All damage to portions of structures which are to remain in place will be repaired by the Contractor at his expense. Reinforcing steel, projecting from the remaining structure, will be cleaned and aligned to provide bond with new extension. Dowels are to be securely grouted with approved grout. Depressions resulting from the removal of structures, footings, and other obstructions, shall be filled and compacted with clean fill materials so as to eliminate hazards of cave in, accumulation and ponding of water.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Permits: Obtain all required permits

1.03 PROJECT CONDITIONS

A. Construction Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities to include adjacent project areas under construction or temporary access. Do not close or obstruct public streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protection necessary to prevent damage to existing Improvements indicated to remain in place. Provide necessary fencing or barricades.
   1. Protect all improvements on adjoining properties and on Owner's property.

2. Restore damaged improvements to their original condition, as acceptable to property Owners, or Authorities having jurisdiction.

C. Existing Bench Marks and Monuments: Carefully preserve and maintain existing benchmarks, horizontal/vertical control monuments, property line pipes and pins and other reference points. If disturbed or destroyed, restore or replace at no additional cost to Project Manager by Contractor.

D. Environmental Requirements: Blasting is not permitted. Employ jack hammering and other loud noises and methods sparingly; comply with all applicable noise abatement ordinances or regulations. Onsite burning is not allowed.

E. Excess Materials: Arrange for disposition of unsuitable materials, waste materials, and materials not allowed by specifications for fill, backfill, or site grading in accordance with local requirements. Location of dump, length of haul, and disposal expenses are Contractor's responsibility.

F. Salvage Improvements: Carefully remove items indicated to be salvaged and store on Project Manager's premises where indicated or as directed by specifications, construction plans and/or by Project Manager.

## PART 2 - PRODUCTS

Not Required.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work of this section will be performed. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.

3.02 SITE CLEARING

A. General: Remove shrubs, grass, and other vegetation or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of existing sod and topsoil.

1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
2. Dispose of topsoil as specified for disposal of waste material at Contractor's expense.

B. Clearing and Grubbing: Clear site except areas that are to be undisturbed of trees, shrubs, and other vegetation, as defined herein. The term clearing and grubbing means the scalping and removal of on-grade and below grade vegetable growth, organic materials, trash, rubbish and other obstructions, interfering with paving and fill areas.

C. Completely remove stumps, roots, and other debris protruding through ground surface or conflicting with proposed construction. All areas with proposed appurtenances and utilities shall be cleared and grubbed to a minimum depth of 5' below existing ground surface.

D. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact each layer to a density equal to adjacent original ground, or as identified with referenced subsurface investigation report and specifications within.

E. Removal of Existing Improvements: Remove existing above-grade and below-grade improvements and utilities as necessary to facilitate proposed construction or future construction within identified limits.

1. Abandonment and Removal: Removing all abandoned underground piping or conduits

interfering with construction is included under this Section, abandonments to include plugging of conduit, shall meet specifications of governing agency having jurisdiction over utility.

F. The Contractor shall notify all public utility companies and determine the location of all existing underground utilities prior to proceeding with construction. All work performed in the area of existing public utilities shall be performed according to the requirements of those agencies. The Contractor shall be responsible for locating any existing utility (including depth) which may conflict with the proposed construction. The Contractor shall protect, at his own expense, all existing utilities and be responsible for their repair if they are damaged during construction.

G. All known existing utilities are shown in approximate locations on the plans. The actual location may vary from the plans, especially in the case of underground permanent and temporary utilities. This Contractor shall pothole and determine the horizontal and vertical location of utilities that may be critical to his operation. Whenever Contractor discovers a discrepancy in locations, he shall contact the Project Manager immediately.

H. Contractor shall have lines identified prior to construction by utility company determining depth and horizontal location. Contractor shall be responsible for repair if damages occur during construction.

3.03 DISPOSAL OF WASTE MATERIALS

A. Burning on Property: Burning is not permitted on property.

B. Removal to Project Manager's Storage Area: Transport excess and salvageable materials to location designated by Project Manager.

3.04 CLEANING

A. Remove excess materials, debris, and equipment in accordance with General and Supplementary Conditions. Keep public or private ways, access roadways, streets and driveways used as access or egress to or from project site free from materials falling from trucks. Promptly clean streets, roadways, etc. to the satisfaction of the Project Manager and public or private Authorities having jurisdiction. A wheel wash area is to be used for removal of debris from vehicles, prior to leaving the site.

**END OF SECTION**

# SECTION 02200

# EARTHWORK

## PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Provide excavation, rough grading, subgrade preparation, overlotting, filling, backfilling, compaction and disposal of spoil materials as shown on the Drawings to meet line and grade specified herein, or as specified to complete the Work. All spoil material shall be stockpiled or hauled and disposed as directed by the Project Manager.
2. Material excavated shall be defined as "unclassified excavation" and shall include all excavation performed under this item regardless of material encountered except for contaminated material requiring special handling and disposal.
3. All site work and excavation shall be completed as detailed on the accepted plans.

B. Related Sections:

1. Selective Clearing: Section 02115.
2. Trenching, Backfill, Compacting for Utilities: Section 02221.
3. Topsoil, Fine Grading & Soil Preparation: Section 02920.

C. Related Documents:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section, to also include the following.
2. Survey Control Monumentation Record and Topography Survey, prepared by the Project Surveyor.
3. Geotechnical Engineering Report

1.02 REFERENCE STANDARDS

A. Comply with the requirements of the reference standards noted herein, except where more stringent requirements are listed herein or otherwise required by the Contract Documents to include specifications of the City of Denver for installation of storm sewers and other earthwork provisions.

1.03 DEFINITIONS

A. Excavation consists of removal of material encountered to subgrade or over-excavation elevations indicated and subsequent disposal or placement of materials removed.

B. Unauthorized excavation consists of inadvertent or purposely removing materials beyond indicated subgrade elevations or dimensions without specific direction of Project Manager. Unauthorized excavation, as well as remedial work resulting from unauthorized excavation directed by Project Manager, shall be at Contractor's expense.

1. Backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Project Manager.
2. Unauthorized excavation, including deposition of additional excavated materials and other work resulting from slides, cave-ins or remedial work shall be at Contractor's expense.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Project Manager, who will make an inspection of conditions. If tests determine that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by testing firm or Contractor.

D. Subgrade: The undisturbed earth or the compacted soil layer immediately below proposed pavement, slab on grade, slab gravel fill, topping materials or structure.

E. Structure: Buildings, foundations, slabs, tanks, tunnel, pavement, curbs, or other man-made

stationary features occurring above or below ground surface.

F. Structural Fill: The term "structural fill", as used herein, includes soil materials used for fill beneath and within 5'-0" of buildings, including fill used under fill supported slabs and the upper 3'-0" of fill under pavements.

G. Trench Backfill: The term "Trench Backfill", as used herein, includes soil materials used for backfilling utility or other trenches outside the building line.

H. Unclassified Excavation: The term "unclassified excavation", as used herein, includes the excavation of all materials required for the work obtained within construction limits of project, including bedrock, surface boulders, wasted sections of concrete, asphalt or other debris.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with all applicable local, state and Federal rules, regulations and ordinances concerning sloping of excavation, trenching and safety of workers, including the latest OSHA requirements. The Contractor shall obtain all necessary permits as required in the General Condition and/or any permits required by Section 1000 prior to commencement of the work.

1.05 PROJECT CONDITIONS

A. Site Information: Data in subsurface investigation reports was used for the basis of the design and is available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. Contractor will be responsible for interpretations or conclusions drawn from this report.

1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

B. Existing Utilities: The Contractor shall notify all public utility companies and determine the location of all existing underground utilities prior to proceeding with construction. All work performed in the area of public utilities shall be performed according to the requirements of these agencies. The Contractor shall be responsible for locating any existing utility (including depth) which may conflict with the proposed construction. The Contractor shall protect, at his own expense, all existing utilities and be responsible for their repair if they are damaged during construction.

1. All known existing utilities are shown in approximate locations on the plans. The actual location may vary from the plans, especially in the case of underground utilities. Whenever Contractor discovers a discrepancy in locations, he shall notify the Project Manager immediately.
2. Demolish and completely remove from site existing underground utilities indicated to be removed. Salvage items are identified on the Drawings and in these specifications. Coordinate with utility companies or agencies for shutoff of services if lines are active.

C. Use of Explosives: Use of explosives is not permitted.

D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction and Project Manager.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

E. Verification of Existing Conditions: Visit the site prior to submission of bids. Verify existing conditions, elevations, and contours. In the event of discrepancies between existing conditions and the requirements of the Contract Documents, contact the Project Manager for clarification.

F. Existing Bench Marks: Carefully preserve and maintain existing bench marks, vertical/horizontal control, monuments, property line pipes and pins, and other reference points. If disturbed or

destroyed, restore or replace at no additional cost to the Project Manager.

## PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: All fill material, regardless of intended use category, must be clean and free from organic matter, roots, brush or other vegetation, trash, brick, debris or other detrimental substances, and rocks or unbroken lumps larger 4". The Owner's Geotechnical Engineer should evaluate any fill used on the site. Fill used should be a non-expansive material similar to the site materials. Imported soils should meet the criteria as recommended in 3.10, F. this section.

1. The site soils are normal for the area and should be removable with normal heavy-duty equipment. Although not encountered during the Geotechnical Engineering study, it is possible on any site in a redeveloped area that hazardous substances may exist in the fill or underlying native materials. During the excavation phase of the project, it is recommended that a representative of the Geotechnical Engineer make frequent observations to verify the condition of the existing fill materials and to determine if there is reason to believe that any of these materials are hazardous.
2. Structural Fill: Provide select, non-expansive, sandy fill with liquid limit, and gradation shown above. If sufficient materials meeting the above requirements are not available from on-site sources, provide additional material obtained from off-site sources and approved by the testing and inspections agency, at no additional cost to the Owner; it is assumed that on-site materials can be used as structural fill.
3. Trench Backfill: The upper 3'-0" of trenches below pavement and fill supported slabs shall be structural fill as specified above. Material conforming to the requirements for overlot fill as specified above may be used for backfilling all other trenches.

2.02 SOURCE QUALITY CONTROL

A. Fill and Backfill Materials: All fill and backfill should be approved by the Geotechnical Engineer, placed in uniform lifts with a thickness compatible with the type of compaction equipment being used, moisture conditioned to within 2% of optimum and compacted with the appropriate equipment. The following minimum percentages of the maximum dry density as determined by ASTM D698 (Standard Proctor) are recommended:

| | |
|---|---|
| 1. Below foundations | 98% |
| 2. Below floor slabs | 96% |
| 3. Below paved areas | 95% |
| 4. Landscaped area fill | 90% |
| 5. Retaining walls | 95% |

B. Where relatively clean, free-draining non-proctorable sands or sand and gravel mixtures are used as fill, compact to at least 65% of Relative Density (ASTM D4253 and D4254).

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Site Visit: Visit and inspect site and take into consideration known or reasonable inferable conditions affecting work. Failure to visit site will not relieve Contractor of furnishing materials or performing work required.

B. Existing Utilities: Locate existing underground utilities in areas of the work. If utilities are to remain in place or be relocated later in construction, provide protection during earthwork operations. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Project Manager immediately for direction. Cooperate with utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the appropriate utility company.

3.02 SITE CLEARING AND SUBGRADE PREPARATION

A. Strip and remove existing pavement materials, vegetation, debris, and other deleterious materials from proposed structure, pavement, ball field, and hockey rink areas. All exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.

B. If unexpected fills or underground facilities are encountered during site clearing, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction. All excavations should be observed by the geotechnical engineer prior to backfill placement.

C. Stripped materials consisting of vegetation and organic materials should be wasted from the site or used to revegetate exposed slopes after completion of grading operations. If it is necessary to dispose of organic materials on-site, they should be placed in non-structural areas and in fill sections not exceeding 5' in height.

D. All exposed areas which will receive fill, floor slabs and/or pavement, once properly cleared should be scarified to a minimum depth of 12", conditioned to near optimum moisture content and compacted.

3.03 GENERAL PROCEDURES

A. Removal: Demolish and completely remove from the project site all existing underground utilities indicated to be removed. Coordinate with utility companies for discontinuance of services if lines are active.

B. Protection of Persons and Property: Provide all necessary measures to protect workmen and passerby. Barricade open excavations occurring as part of the work, as required by municipal or other authorities having jurisdiction.

C. Protect adjacent streets, roadways, and properties throughout the entire operation. Protect newly graded areas from destruction by weather or runoff. Protect structures, utilities, sidewalks, pavements, and other improvements from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

3.04 EXCAVATION

A. Excavation is all considered unclassified and includes excavation to subgrade or over-excavation elevations indicated, regardless of character of materials and obstructions encountered.

B. It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

C. Depending upon depth of excavation and seasonal conditions, groundwater may be encountered in excavations on the site. Pumping from sumps may be utilized to control water within excavations.

D. Use of lime, fly ash, kiln dust, cement or geotextiles could also be considered as a stabilization technique. Laboratory evaluation is recommended to determine the effect of chemical stabilization on subgrade soils prior to construction.

3.05 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction to include the latest revision to OSHA standards. Safety is the sole responsibility of the Contractor.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights,

stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

3.06 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to sediment basin to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collection in sediment basins. Do not use trench excavations as temporary drainage ditches. Discharge directly to storm sewer prior to removal of sediment shall not be permitted.

3.07 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill as indicated by Project Manager. Place, grade, and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations.
2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill as directed by Project Manager.

3.08 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9" of clearance on both sides of pipe or conduit.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

1. For pipes and equipment 6" or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads ensure continuous bearing of pipe barrel on bearing surface.

3.09 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35° F.

B. Dust Control: Provide dust control as required to alleviate dust nuisance to the public, to adjacent properties and other work underway at the project site.

C. Unanticipated Conditions: Notify the Project Manager immediately upon finding evidence of previous structures, filled materials which penetrate below designated excavation levels, or other conditions which are not shown or which cannot be reasonably assumed from existing surveys and geotechnical reports. Secure the Project Manager instruction before proceeding with further work in such areas.

D. Unsatisfactory Soils: Remove or otherwise correct unsanitary, sour, or otherwise unsatisfactory soil. Remove contaminated or unsuitable material from under building and paved areas.

3.10 BACKFILL AND FILL

A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in this Section.

B. Under grassed areas, use satisfactory excavated or borrow material, overlot fill.

C. On-site granular and approved imported materials may be used as fill material for the following:

- general site grading
- foundation areas
- floor slab areas
- exterior slab areas
- pavement areas
- foundation backfill

D. On-site existing clay and claystone are not recommended for use directly beneath proposed structures, unless a structural slab is used. However, these materials can be placed in pavement, non-structural areas and within deeper fill areas below the depths of removal and replacement as previously outlined.

E. Frozen soils should not be used as fill or backfill.

F. Imported soils (if required) should conform to the following or be approved by the Project Geotechnical Engineer:

| Gradation | Percent finer by weight (ASTM C136) |
|---|---|
| 6"100 | |
| 3"70-100 | |
| No. 4 Sieve | 50-80 |
| No. 200 Sieve | 35 (max) |

- Liquid Limit ..... 30 (max)
- Plasticity Index ..... 15 (max)
- Maximum expansive potential (%)* ..... 1.5

* Measured on a sample compacted to approximately 95% of the ASTM D698 maximum dry density at about 3% below optimum water content. The sample is confined under a 100 psf surcharge and submerged.

1. Do not backfill trenches until tests or inspections have been made and backfilling is authorized by Project Manager. Use care in backfilling to avoid damage or displacement of pipe systems.

G. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.11 PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

1. When existing ground surface after compaction process has a density less than that specified under compaction requirements; for a particular area classification, break up ground surface. Scarify existing subgrade to depth of 6" prior to compacting and placing fill. Moisture condition

between 2% below and 2% above optimum moisture content, and recompact to at least 95% of maximum Standard Proctor density (ASTM D698).

B. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers, each layer to be compacted to meet requirements herein.

C. Compaction Requirements:
1. The following general compaction specifications should be observed on this project.
   a. Place and compact fill in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift.
   b. No fill should be placed over frozen ground.
   c. Materials should be compacted to the following:

| Material | Minimum Percent (ASTM D698) |
|---|---|
| Subgrade soils beneath fill areas | 95 |
| On-site soils or approved imported fill: | |
| Beneath foundations | 98 |
| Beneath slabs | 95 |
| Beneath pavements | 95 |
| Miscellaneous backfill | 90 |

   d. Granular or imported soils should be compacted within a moisture content range of 3% below to 3% above optimum unless modified by the project geotechnical engineer.
   e. Clay soils should be compacted within a moisture content range of optimum to 2% above optimum.

D. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

E. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

F. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by testing agency if soil density tests indicate inadequate compaction.
1. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
3. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.12 SHRINKAGE

A. Shrinkage: For balancing grading plans, estimated shrink or swell of soils and bedrock when used as compacted fill following recommendations in this report are as follows:

| Material | Estimated Shrink(-) Swell (+) Based on ASTM D698 |
|---|---|
| On-site soils: | |
| Clays | -5 to -10% |
| Sands | -5 to -15% |
| On-site bedrock materials | |
| Claystone | +5 to +10% |
| Sandstone | -5 to -10% |

3.13 GRADING

A. General: Uniformly grade areas within project limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations or contours are indicated or between such points and existing grades.

B. Finish surfaces free from irregular surface changes and as follows:
   1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
   2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
   3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 0.00 to 0.17 foot above required subgrade elevation.

C. Grading Surface of Fill under Structural Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 0.05 foot when tested with a 10-foot straightedge.

D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.14 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction and erosion control plan submitted as part of the Construction Documents.

3.15 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal to designated areas on property: Transport acceptable excess excavated material to designated soil storage areas on property.

B. Removal from Property: Remove waste materials, including materials not allowed for fill, backfill or site grading as specified within, trash, and debris, and dispose of it off property at Contractor's

expense.

**END OF SECTION**

# SECTION 02270

# TEMPORARY EROSION AND SEDIMENTATION CONTROL

## PART 1 - GENERAL

### 1.1 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply if provided, to this Section.

### 1.2 SUMMARY

A. Work Included. Furnish, install, maintain, and remove temporary erosion and sedimentation controls as shown on the drawings or specified herein, or as required to complete the work.

B. Related Sections include the following:

1. Division 2 Section "Site Clearing" site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Division 2 Section "Subdrainage Systems" for drainage of slabs-on-grade and landscaped areas.
3. Division 2 Section "Earthwork" for soil materials, site excavating, filling and grading.
4. Division 2 Section "Trenching" for excavating and backfilling of utilities.

B. Permits and Fees: Obtain and pay for all permits and fees required for the work of this section, including erosion and sediment control and water quality permits required by the authority having jurisdiction and the Colorado Department of Public Health and Environment, Water Quality Control Division.

C. Erosion Control: The Erosion and Sedimentation Control Drawings included in the Contract Documents is the minimum requirement to be implemented. Provide additional control as necessary to meet applicable local and State criteria.

### 1.3 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Unclassified Excavation: Removal of all material of whatever character required for the work encountered above subgrade elevations and to lines and dimensions indicated, including boulders.

C. Fill: Fill is all material placed to raise the grade of the site or to backfill excavation, upon which the Soils Engineer has made sufficient tests and observations to enable him to issue a written statement that, in his opinion, the fill has been placed and compacted in accordance with the requirements of these specifications.

D. BMP: Best Management Practice. Erosion and sediment control devices, which may consist of silt fence, crates, filter fabric, riprap, etc.

E. SWMP: Storm Water Management Plan. Identifies BMPs, which are erosion and sediment control measures for the project.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

H. Utilities: Include on-site underground pipes, conduits, ducts, and cables, as well as underground services to buildings.

## 1.4 SUBMITTALS

A. Submittal Procedures: All submittals are to be made to the Owner's Representative. If provided refer to Division 1 section "Submittals."

B. Product Data: not required.

## 1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable local, State and Federal ordinances, rules and regulations concerning sedimentation control and storm water runoff.

B. In case of conflict between the above codes, regulations, references and standards and these specifications, the more stringent requirements shall govern.

C. Preconstruction Conference: Conduct conference at Project site as directed by Owner's Representative prior to start of construction. Contractor to comply with requirements, which may also be included in Division 1 Section "Project Management and Coordination."

## 1.6 PROJECT/SITE CONDITIONS

A. Existing Conditions: Verify all existing conditions affecting the work of this section prior to submitting bids or proposals. Additional compensation will not be allowed for revisions or modification of work resulting from failure to verify existing conditions.

## 1.7 WARRANTY

A. Temporary Erosion and Sediment Control measures shall be maintained until permanent measures are in place. All damaged, disturbed or devices filled with sediment, which may occur within the specified project warranty period, shall be corrected at no cost to the Owner. Any devices damaged by erosion or sediment shall be restored to their original condition by the Contractor, at no cost to the Owner.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Erosion and Sedimentation Control Materials: Provide one or more of the following materials, as shown on the plans or as applicable for site conditions:

1. Sand bags.
2. Clean, seed-free, certified, cereal hay or grain straw bales.
3. Silt fences.
4. Rock riprap.
5. Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh.
6. Biodegradable twisted jute or spun-coir mesh, 0.92 lb/sy minimum, with 50 to 65 percent open area.
7. Drainage geotextile.
8. Impervious fill.
9. Other materials proposed for use on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. General:

1. Determine the existing ground elevations, drainage patterns, and changes to such patterns during excavation in order to satisfactorily plan and provide materials for adequate erosion and sediment control devices.

### 3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and rights-of-way according to requirements of authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

D. Secure grading permit from agency have jurisdiction prior to commencing grading operations, if required.

### 3.3 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work of this section will be performed. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.

## 3.4 INSTALLATION

A. Erosion and Sedimentation Control Devices. Erosion and sedimentation control measures to be taken during construction include, but are not necessarily limited to the following:

1. Apply soil stabilization within 14 days to all disturbed areas that are to be dormant for a period longer than 30 calendar days after reaching grade. Stabilize soil with mulch anchored per criteria of authorities having jurisdiction. Temporarily revegetate areas that will remain in an interim condition for more than three months.
2. Roads and parking areas indicated to be paved may be covered with an appropriate aggregate base course in lieu of mulch. Temporary mulching or aggregate base course is not required if final pavement construction will take place within 30 days after grading to final contours.
3. Soils that will be stockpiled for more than 30 days must be mulched and seeded within 14 days after stockpile construction.
4. Prevent sediment from leaving the project site by installing a silt fence or other BMPs as indicated on the plans. Protect existing storm inlets adjacent to the site by an approved gravel filter.
5. Excavate the future detention/water quality pond and construct the outlet structure/storm sewer such that the pond may function as a temporary sediment basin during development of the site. Construct the sediment basin in accordance with authority having jurisdiction's criteria. Provide temporary swales to convey site runoff to the pond.
6. Locate stone stabilization pads at all points of vehicular ingress and egress to the construction site.
7. Provide temporary erosion controls consisting of berms at the top of slopes and interceptor ditches at ends of berms and at those locations which will eliminate or minimize erosion during construction, along with temporary seeding, temporary diversion, chutes, and down pipes and lining of water courses.
8. Temporary sedimentation controls shall consist of silt dams, traps, silt fence, barriers, and appurtenances at the top of spoil and borrow area slopes and where runoff water exits the site.
9. Maintain the available silt holding capacity of silt dams, fence traps and barriers until no longer needed. The sediment capacity of sediment retainage areas shall be at a minimum, the capacity shown on the plans in conformance with Urban Drainage Criteria Manual, Volume 3. Prior to removal, obtain concurrence of the Owner and Engineer.
10. Remove accumulated sediment and debris from a BMP when the sediment level reaches one-half the height of the BMP, or at any time the sediment or debris adversely impacts the functioning of the BMP.
11. Remove hay bales which have deteriorated and filter stone or cloth which has become dislodged. Place new hay bales and new filter and fence.
12. The erosion/sediment control plan shows the minimum required for the project. If it becomes apparent that additional controls are necessary, the Engineer shall be notified and with approval of the Owner's Representative additional controls shall be installed.

B. Chemicals and Pollutants:

1. Store construction materials and chemicals that could contribute pollutants to the runoff within an enclosure, container, or dike located around the perimeter of the storage area, to prevent discharge of these materials into runoff from the construction site.
2. Locate areas used for collection and temporary storage of solid and liquid waste away from the storm drainage system. Provide covering or fencing as required to prevent windblown materials; construct perimeter dike to contain liquid runoff. These measures may not be necessary if materials are immediately placed in covered waste containers.
3. Perform equipment maintenance in designated areas using measures such as drip pans to control petroleum products spillage.
4. Immediately clean up and properly dispose of spills of construction related materials such as paints, solvents, or other chemicals.

C. Final Stabilization and Long-Term Management

1. Final stabilization shall be achieved through permanent vegetation and landscaping after construction of all buildings and paved surfaces.
2. Temporary erosion and sediment control measures may be removed within 30 days after final site stabilization is achieved or after temporary measures are no longer needed.

B. Inspection and Maintenance: Inspect erosion and sediment control measures weekly during construction. In addition, inspect all facilities immediately after any significant runoff or snowmelt which results in runoff. Repair or otherwise mitigate any damage to the erosion and sediment control facilities at no additional cost to the Owner.

## 3.5 CLEANING

A. Removal of Controls: Remove controls upon completion of that portion of the work for which controls were furnished. Leave the site and work area in a clean condition.

**END OF SECTION**

# SECTION 02317

## TRENCHING, BACKFILLING, COMPACTING FOR UTILITIES

### PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. This work shall consist of furnishing all labor, materials tools and equipment for trenching, bedding, backfill and compaction for all underground utilities as specified herein and shown on the accepted plans. The excavation shall be made to lines and grades shown on the accepted plans and as established by the Project Manager. Except where shown otherwise on the accepted plans and except where the Project Manager gives written permission to do otherwise, all trench excavation shall be made by open cut to the depth required to construct the pipelines as shown on the accepted plans. All excavation shall be unclassified.
2. Pavement removal and replacement as required.

B. Related Sections:

1. Earthwork: Section 02200.

C. Related Documents:

1. Geotechnical Engineering Report (not available)

1.02 QUALITY ASSURANCE:

A. Regulatory Requirements: Perform excavation work in conformance to the requirements of authorities having jurisdiction. Supply, install, and remove all shoring as may be required to comply with all safety regulations and to maintain earth banks until backfill is placed.

B. Testing and Inspection: Conform testing and inspection of backfill to the requirements of section 02200. Make in place density tests at intervals and locations as directed by the Project Manager.

1.03 PROJECT/SITE CONDITIONS;

A. Protection: Protect existing utilities, and utility excavations, in accordance with the requirements of Section 02200.

B. Site Information:

1. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Project Manager will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data are made available for the convenience of the Contractor.
2. Soil investigation and test reports are available for examination as set forth in Information Available to Bidders.
3. Additional test borings and other exploratory operations may be made by the Contractor at no cost to the Project Manager.

## PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Fill Materials: Excavated earth, loam, sandy clay, sand and gravel, soft shale, or other acceptable materials, approved by the Owner's Geotechnical Engineer free from organic matter, frozen material and large clods of earth or stone, and of a proper moisture content which will facilitate backfilling.

B. Foundation Materials: In those areas where undisturbed ground is not considered to provide adequate support, foundation material conforming to Section 02200, 3.10 F.

C. Select Backfill:
   1. Job excavated material may be used for select backfill when the job excavated material is finely divided and free from debris, tin cans, frozen earth, rubbish, stumps, organic material, cinders or other corrosive material, stones larger than 12" in greatest dimension or masses of moist, stiff clay.
   2. Graded gravels meeting the Specification for Class 6 Aggregate Base Course may be used as select backfill material.

D. Granular Bedding Materials: Granular bedding material shall be crushed rock or pea gravel with not less than 95% by weight passing 1/2" (95% by weight passing 3/4" for 30" and larger pipe) and not less than 95% retained on a #4 sieve. The Project Manager may accept other gradations if requested in writing. Excavated materials may be used for the upper portion of the bedding if accepted by the Project Manager.

E. Unsuitable Material: Highly organic soil; ASTM D2487 Group PT, topsoil, roots, vegetable matter, trash and debris.

## PART 3 - EXECUTION

3.01 EXECUTION

A. General:
   1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
   2. When rock is encountered in trench bottom, trench shall be over-excavated to a depth of not less than 6" below pipe. The over-excavated material shall be replaced with acceptable bedding material.
   3. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

B. Excavation Classifications:
   1. All excavation is to be considered as "unclassified", except where rock is encountered.

C. Shoring and Bracing:
   1. Provide materials for shoring and bracing, such as sheet piling, up rights, stringers and cross-braces, in good serviceable condition. Provide shoring as required for safety and by governing authorities.
   2. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
   3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses. Arrange shoring and bracing so as not to place stress on completed work.
   4. Exercise care in removal of shoring and bracing to prevent collapse or caving of excavation faces.

D. Dewatering:

1. Prevent surface water from flowing into excavations and from flooding project site and surrounding areas.
2. Do not allow water to accumulate in excavations. Remove water to prevent softening of trench bottoms, and soil changes detrimental to stability of subgrades and foundations.
3. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
4. Convey water removed from excavations and rain water to collecting or run off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure.
5. Do not use pipe trench excavations as temporary drainage ditches.

E. Cold Weather Protection:
1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.

F. Material Storage:
1. Stockpile satisfactory excavated materials on site or where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
2. Locate and retain soil materials away from edge of excavations a distance equal to the depth of the excavation or more.

G. Trenching:
1. Excavate trenches through all materials encountered to depths shown on Drawings. Dispose of excavated materials not suitable for backfill off site.
2. Excavate for manholes, vaults and other appurtenances with clearances between 12" and 24" on all sides.
3. Do not excavate below required levels unless necessary due to wet trench conditions, as determined by the Owner's Soils Engineer. Backfill unnecessary excavation below the required level with granular bedding material as directed by the Owner's Soils Engineer and thoroughly tamp.

H. Bedding:
1. Bed pipe as shown in the bedding details. Provide Class "C" bedding except irrigation pipe add athletic field under drain system which shall be bedded in accordance with the irrigation and underdrain pipe bedding detail.

3.02 CONTROLLED FILL

A. After pipe bedding has been completed in accordance with applicable pipeline Sections, carefully backfill trenches using approved excavated materials. Carefully hand tamp around the pipe and up to 12" above the top of the pipe, in lifts not to exceed 6" loose thickness.

B. Use care to place and tamp this course without disturbing joints, alignment, or grade of the piping. Fill remainder of trench in layers not exceeding 8" loose depth where pneumatic, vibratory or other tamping equipment is used.

C. Where crane operated or hydraulic drop hammers are used to compact the remainder of the backfill, limit loose depth of each lift to 3'.

D. Use care in backfilling and compacting operations to avoid disturbing pipe. Replace misaligned, crushed or otherwise disturbed main piping.

E. Exercise extreme care in removing cribbing, shoring or sheeting so as not to disturb foundation, bedding and initial backfill. Where necessary to drive sheet piling or shoring below top of pipe, cut off sheet piling or shoring 12" above top of pipe and leave in place.

F. Where groundwater or wet trench conditions occur, provide additional bedding below and over the pipe consisting of granular bedding material, as defined in pipe line sections, to a depth as required.

If used, payment for the bedding materials shall be only for the additional amount in excess of the standard bedding requirements specified.

G. Re-open trenches improperly backfilled or where settlement occurs, to the depth required for proper compacting, then refill and compact, restoring the surface to the required grade, compaction, and smoothness.

H. Pooling or water flooding for consolidating the backfill will not be permitted, and the addition of water is limited to that needed for obtaining the desired moisture content specified.

3.03 PAVEMENT REMOVAL AND REPLACEMENT

A. Saw cut to create clean break line. Remove and dispose of existing surface and aggregate base course. Leave 6" undisturbed subgrade lip on each side of trench. After trench has been backfilled and properly compacted, place aggregate base course in accordance with existing thickness. Compact aggregate base course to 95% AASHTO T180. Replace pavement in accordance with permit requirements or minimum thickness specified. Compact asphalt to 95% ASTM D1559.

B. Replace sections (between joints) of concrete work. Remove and dispose of waste material. Compact and prepare subgrade for concrete in accordance with Section 02200.

3.04 QUALITY CONTROL

A. Soil Compaction Tests:
   1. Determine maximum density and optimum moisture content of backfill material in accordance with ASTM D698.
   2. Moisture Content: Adjust and maintain moisture content of the soil within ±2% of optimum moisture content.

B. Compaction Requirements:
   1. Compact backfill in utility trenches to not less than 95% maximum density from the top of the granular bedding to the top of the trench.
   2. Replace disturbed surface materials with material matching existing and adjacent materials.

**END OF SECTION**

# SECTION 02810
# IRRIGATION SYSTEM

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section Includes: Work in this Section generally includes provisions for the complete installation of an irrigation system, including but not limited to all labor, supplies, equipment, tools and transportation. Items of work specifically included are:
   1. Procurement of all appropriate licenses, permits and fees.
   2. Coordination of all utility locates.
   3. Trenching, stockpiling excavation materials, refilling and compacting trenches.
   4. Complete irrigation system including but not limited to piping, backflow preventer assemblies, valves, fittings, heads, connection of electrical power supply to the control system and final adjustments to insure complete coverage.
   5. Water connections.
   6. Sleeving for irrigation pipe and control wire.
   7. Replacement of unsatisfactory materials.
   8. Clean-up, inspections, approval, testing and maintenance period.

B. Related Sections:
   1. Examine all Sections related to project work.

### 1.02 WORK NOT INCLUDED

A. Items of work specifically excluded or covered under other sections are:
   1. Provision of electrical power supply to the control system.
   2. Installation of water meter for irrigation system.

### 1.03 SUBMITTALS

A. Manufacturer's Data: Prior to construction, Manufacturer's catalog cuts, specifications and operating instructions, for each type and piece of equipment specified herein.

B. Shop Drawings: Prior to construction, submit shop drawings called for in the installation details. Show products required for proper installation, their relative locations and critical dimensions.

C. Quality Control Submittals:
   1. Design: Any deviations from the proposed irrigation design must be approved by the Architect prior to construction. Submit three (3) copies of any design deviations before commencing any work.
      a. Design Criteria: Any deviation in design shall conform to the head and valve locations, pipe routing, zoning, and stationing indicated on the Drawings(s). Lateral piping is sized in accordance with recognized standards based on flow demands (GPM's) with velocities designed not to exceed five feet (5') per second. Lateral piping shall not be used less than one inch (1") I.D. Pipe shall be reduced no less than six inches (6") beyond the last tee of a larger pipe size.

### 1.04 RULES, REGULATIONS AND REFERENCES

A. Ordinances and Regulations: Local, municipal and state laws and regulations governing or relating to any portion of this work (including but not limited to the latest edition of the National Electric Code and Uniform Plumbing Code) are hereby incorporated into and made a part of these specifications and their provisions shall be carried out by the Contractor. Anything contained in these Specifications shall not be construed to conflict with any of the aforementioned rules and

regulations. However, when these Specifications and Drawings call for or describe materials, workmanship, or construction of a higher quality, standard or larger size than is required by the above rules and regulations, the provisions of these Specifications and Drawings shall take precedence.

B. References: Conform to requirements of reference information listed below except where more stringent requirements are shown or specified in Contract Documents.
   1. American Society for Testing and Materials (ASTM): Specifications and Test Methods specifically referenced in this Section.
   2. Underwriters Laboratories (UL) - UL Wires and Cables.

1.05 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver all components in original containers and/or with original labels intact. Transport pipe only on vehicle or trailer long enough to allow pipe to lie flat to avoid undue bending. Repair dented pipe before installation. Replace damaged or discolored pipe immediately.

B. Storage and Protection: Prevent damage to components during loading, transportation and unloading and store components in a clean dry location until they are installed.

1.06 SITE CONDITIONS

A. Existing Conditions:
   1. Contractor is responsible for knowing the information contained in the Drawing(s) and Specifications for all earthwork and other related operations and verifying that the existing site conditions are as specified and indicated in those documents before beginning work under this Section.
   2. Preserve and protect all trees, plants, monuments, structures, and paved areas from damage due to work of this Section. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to satisfaction of Owner and all injury to living plants shall be repaired by Owner. All costs of such repairs shall be charged to and paid by Contractor.
   3. Protect buildings, walks, walls and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete or other building material surfaces shall be repaired or replaced at no cost to Owner. Restore disturbed areas to original condition.
   4. Report unsatisfactory conditions in writing to the General Contractor and Architect.
   5. Beginning of installation means acceptance of existing conditions by this Contractor.
   6. Tolerances: Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, compaction, and repair of finish grade treatment.
   7. Coordination with other contractors: Protect, maintain and coordinate work with work under other Sections.
   8. Damage to other improvements: Contractor shall replace or repair damage to grading, soil preparation, seeding, sodding, or planting done under other Sections during work associated with installation of irrigation system at no additional cost to Owner.

1.07 GUARANTEE / WARRANTY AND REPLACEMENT

A. For a period of one (1) year from commencement of the formal maintenance period, guarantee/warranty irrigation materials, equipment and workmanship against defects, unless stated otherwise in the General Conditions of the contract. Fill and repair settling of backfilled trenches or depressions. Restore landscape or structural features damaged by the settlement of irrigation trenches or excavations. Repair or replace damage to the area caused by a defective item.

B. Contract documents govern replacements identically as with new work. Replacements shall be made with no additional costs to the Owner.

C. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.

D. Expenses due to vandalism before Substantial Completion shall be borne by Contractor.

E. Maintenance During Warranty Period:
1. Make repairs and replacements needed due to defective workmanship and materials.
2. Make repairs within three (3) days of notification. If Contractor fails to make repairs within three (3) days, Owner may make such repairs at Contractor's expense. If in Owner's judgment an emergency exists, Owner may make repairs at Contractor's expense.

1.08 TESTING AND FLUSHING

A. General: Notify the Architect a minimum of five (5) days in advance of testing. Furnish clean, clear water, pumps, labor, fittings and equipment necessary to conduct tests or re-tests.

B. Testing:
1. Hydrostatic Pressure Test:
   a. Hydrostatically test the mainline piping and electric control valves in place before backfilling. Electric control valves must be in place for test. Close tightly isolation valves on mainline for tests. Backfill to prevent pipe from moving under pressure.
   b. Purge all air from pipeline before test.
   c. Attach pressure gauge to pipeline in test section. After backfilling and installation of all control valves, fill mainline with water, and pressurize to forty (40) PSI over the designated static pressure or one-hundred twenty (120) PSI, whichever is greater, for a period of two (2) hours. Test each section of pipe between isolation gate valves on the mainline pipe separately.
   d. Observe pressure loss on pressure gauge. If pressure loss is greater than two (2) PSI, identify reason for pressure loss.
   e. Replace defective PVC pipe, fitting, joint, or valve with new part. No pipe splices will be accepted within sleeve pipe. No PVC pressure couplings or slip-fix repair couplings will be allowed. Cement of caulking to seal leaks is prohibited.
   f. Retest the system until the pressure loss is equal to or less than two (2) PSI.
   g. Before Final Acceptance, pressure supply line shall remain under pressure for a period of forty-eight (48) hours.
2. Operational Test:
   a. After installation of sprinkler heads and quick coupling assemblies, test entire system for operation under normal operating pressure.
   b. Test heads in each valve zone for ten (10) minutes (minimum).
   c. Operate controller in sequence through two (2) complete cycles or each zone for two (2) minutes minimum. The Architect will observe operation, water application patterns and leakage.
   d. Replace, adjust or move sprinkler heads to correct operational or coverage deficiencies. Repair leaks, defective pipe, fittings, joints, valves, or sprinklers and repeat test until each lateral passes all tests.
   e. Test is acceptable if system operates in a satisfactory manner with uniform coverage of areas to be sprinkled and no leaks occur during any testing procedure.

PART 2 - PRODUCTS

2.01 GENERAL

A. Equipment must have performance characteristics to operate per the design conditions indicated. If any discrepancy or conflict exists between the quantities or types of equipment listed on the Drawings and Specifications, and no specific interpretation is issued prior to bidding, the decision regarding this interpretation will rest with the Architect. The Contractor is to act on this decision as directed.

B. Explanation of Drawings: Due to the scale of the Drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. Carefully investigate the structural and finished conditions affecting all of this work and plan this work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. The Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, landscape plantings and site features.

C. Substitutions: Acceptable equipment Manufacturer's are indicated on the Drawings. Substitute equipment must be approved by the Architect prior to bidding. Pipe sizes referenced on the Drawings are minimum sizes and may be increased at the option of the Contractor.

2.02 EQUIPMENT

A. Pressure Supply Lines: Is that piping commencing at the water source/ tap, through the point of connection components to a below-grade transition to PVC main line.
   1. Type "K" rigid, seamless copper water tube, ASTM B88, for three inch (3") lines or smaller.
      a. All joints: Silver soldered.
      b. All fittings through the backflow preventer to be copper.
      c. Provide brass union at the backflow preventer.
   2. Comply with applicable codes or supply/ service line installation standards.

B. Pipe and Fittings:
   1. Pressure Main Line and Fittings: Is that piping commencing at the point of connection to the various automatic control valves (downstream of backflow prevention units).
      a. Use rigid, PVC 1120 or 1220 NSF approved pipe conforming to ASTM D-2241 and ASTM D1784, cell classification 12454 –A or 12454-B, Type 1, Grade 1, with an integral belled end.
      b. Use Class 200, SDR 21 pressure rated at 200 PSI at 73.4 degrees F., conforming to the dimensions and tolerances established by ASTM D-2241.
      c. Use rubber-gasketed pipe equipped with factory installed reinforced gaskets for mainline pipe with a nominal diameter greater than or equal to three inches (3"). Gasketed pipe joints must conform to the Laboratory Qualifying Tests section of ASTM D-3139. Gasket material must conform to ASTM F-477. Use rubber-gasketed deep bell ductile fittings conforming to ASTM A-536 and ASTM F-477. Use lubricant approved by the pipe Manufacturer.
      d. Use solvent weld pipe for mainline pipe with a nominal diameter less than three inches (3") or where a pipe connection occurs in a sleeve. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by the pipe Manufacturer. Solvent cement to conform to ASTM Standard D2564.
   2. Lateral Pipe and Fittings: Is that piping commencing at the various automatic control valves to the sprinkler heads.
      a. Use rigid, PVC 1120 or 1220 NSF approved pipe conforming to ASTM D-2241 and ASTM D-1784, cell classification 12454 –A or 12454-B, Type 1, Grade 1, with an integral belled end suitable for solvent welding.

b. Use Class 200, SDR 21 pressure rated at 200 PSI at 73.4 degrees F., conforming to the dimensions and tolerances established by ASTM D-2241.
c. Use solvent weld pipe for mainline pipe. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by the pipe Manufacturer. Solvent cement to conform to ASTM Standard D2564.

3. Drip Tubing: To be used for lateral lines on drip and micro-jet zones only. (Not allowed for lines greater than two inch (1") diameter.):
   a. Drip Tubing: Hardie Dura-Pol EHD 1645, 3/4" with .050 inch wall thickness.
   b. Emitter Tubing: As recommended by emitter manufacturer.
4. Polyethylene lateral pipe is prohibited.

C. Specialized Fittings:
1. Brass fittings: Medium brass, screwed 125 lb. class.
2. Threaded Pipe Connections: ASTM D2464, PVC Schedule 80 nipples with molded threads and PVC Schedule 40 threaded fittings. Use only teflon tape on plastic threads.

D. Risers:
1. Rotary Head or Quick Coupler Valve: Triple Swing Joints - components include three (3) Schedule 40 elbows, three (3) three inch (3") Schedule 80 nipples, one (1) twelve inches (12") Schedule 80 nipple, and Teflon tape. Factory pre-assembled swing joints are acceptable and recommended.

E. Backflow Preventer: Febco LF 825 YA, 2"

F. Valve Setter: not required.

G. Hydrometer Enclosure:

H. Air Vacuum Relief Valve: As specified in drawings.

I. Isolation Gate Valves: As specified in drawings.
1. Gate Valves for 3/4" through 2-1/2" pipe: Brass construction; solid wedge, IPS threads, and non-rising stem with wheel operating handle.
2. Gate Valves for three inch (3") and Larger Pipe: Iron body, brass or bronze mounted AWWA gate valves with a clear waterway equal to full nominal diameter of valve; rubber gasket or mechanical joint-type only. Valves shall be able to withstand a continuous working pressure of one-hundred fifty (150) PSI (minimum) and be equipped with a square operating nut at sleeves/valve boxes or wheel type handles at manholes or open areas, that opens counterclockwise. Install a separate valve box for each assembly.

K. Electric Control Valves:
1. Size and type shown on Drawings having manual flow adjustment (except drip valves) and manual bleed nut. Use wire connectors and waterproofing sealant to join control wires to solenoid valves. Install a separate valve box for each assembly.
2. Cast brass body and bonnet, globe type. Install with plastic or brass ball valve in-line upstream. Valve shall be normally closed, mechanically molded, single-seat diaphragm-operated, two (2)-way, 24 volt solenoid activated with manual bleed plug and flow adjustment.
   a. Atmosphere vented and three (3) - way solenoid valves are prohibited.

L. Drip Irrigation Assembly:

1. Drip Tubing: Manufactured of flexible vinyl chloride compound conforming to ASTM D-1248, Type 1, Class C, Category 4, P14 and ASTM D-3350 for PE 122111C.
2. Fittings: Type and make recommended by tubing manufacturer.
3. Drip Valve Assembly: Type and size shown on Drawings.
   a. Wye Strainer: Plastic construction with 120 mesh nylon screen and one-half inch (1/2") blow-out assembly.
   b. Control Valve: Two (2) -way, solenoid pilot operated type made of synthetic, non-corrosive material; diaphragm activated and slow closing. Include freely pivoted seat seal; retained (mounted) without attachment to diaphragm.
   c. Pressure Reducing Valve: Plastic construction as detailed.
4. Drip Emitters: Single port, pressure compensating, press on type by Rainbird.
   a. Provide two (2) one gallon per hour emitters for each shrub and four (4) two gallon per hour emitters for each tree.

M. Quick Coupling Valves: Cast brass two-piece body designed for working pressure of one-hundred fifty (150) PSI. Valve shall be equipped with a locking rubber cover. Key size and type as shown on Drawings.

N. Manual Valves: Bronze, angle type, two hundred pounds (200 lbs.) class with cross type operating handles.

O. Valve Boxes:
   1. Isolation Gate Valves, Drip Line Blow-out Stubs, and Wire Stub Box: Carson #910-12, Brooks #1100.
   2. 3/4" through 2" Control Valves and Air-Relief Valves: Carson #1419-13B, Brooks #1419.
   3. Drip Valve Assemblies: Carson #1320-13B.

P. Drainage Sump: Shall contain a minimum of three (3) cubic feet of three-quarters of an inch (3/4") crushed gravel wrapped in geo-textile at all manual drain valve locations.

Q. Automatic Controller:
   1. Size and type shown on Drawings; installed as detailed and noted.

R. Electrical Control Wiring:
   1. Low Voltage:

   C. Electrical Control Wire: Type UF with 4/64" UL listed insulation for underground burial for class II circuits. No. 12 direct burial copper wire or 14 gauge for runs up to 1,000 lineal feet. **Provide four extra positive (black) and one extra ground wire (yellow) entire length of main.**

      a. Wire Colors: wire color shall be continuous over its entire length.
         Control Wires - Red.
         Common Wires - White.
         Master Valve Wires - Blue.
         Spare Control Wires – shall be of a color different from that of the active control wire.
         Spare Common Wires - Yellow.
      b. If multiple controllers are utilized, and wire paths of different controllers cross each other, both common and control wires from each controller shall be different colors approved by the Architect.
      c. Control wire connections an splices shall be made with 3M direct bury splice, Rainbird Pentite connectors, or similar dry splice method.

d. Multi strand wire is prohibited.

2. High Voltage: Type required by local codes and ordinances of proper size to accommodate needs of equipment serviced.

S. Sprinkler Heads:

1. Type and quantity as indicated on Drawings. Fabricated riser units in accordance with details on Drawings and specified herein, with riser nipples of same size as riser opening in sprinkler body.
2. Gear Driven: Plastic body pop-up, with built in check valve, removable nozzle and rubber cover. Provide variable arc settings from to 360 degrees. Nozzles shall have matched precipitation rates. Sprinkler shall have a minimum pop-up height of 4".
3. Pop-up Sprays: Plastic body pop-up, with built-in pressure regulator and check valve, and a removable spray nozzle. Provide pattern plastic nozzles, with matched precipitation rates. Minimum pop-up height shall be four inches (4"), see Drawings for pop-up height. Use appropriate variable arc nozzles in all locations where excessive over spray occurs with the fixed arc nozzles.

T. Sleeving:

1. Sleeving material beneath pedestrian pavements and vehicular drives and streets shall be PVC Class 200 pipe with solvent welded joints. Sleeving diameter is equal to twice that of pipe or wire bundle. Install separate sleeve beneath paved areas to route run of irrigation pipe or wiring bundle.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Verification of Conditions:

1. Verify existing site conditions per Article 1.06 this Section.
2. Soil Conditions: Investigate the type of soil and conditions in which these lines are to be installed and allow for same in proposal. No extra will be allowed due to difficulty in trenching.
3. Grading operations, with the exception of final grading, shall be completed and approved by Owner before staking or installation of any irrigation system begins.

### 3.02 PREPARATION

A. Layout: Layout and stake system before beginning installation. Notify Architect forty-eight (48) hours in advance to inspect layout. Inspection does not relieve installer of coverage problems due to improper placement of heads after staking.

B. Sleeving: Install sleeving under asphalt paving and concrete walks, prior to concreting and paving operations, to accommodate piping and wiring. Compact backfill around sleeves to ninety-five percent (95%) Modified Proctor Density within two percent (2%) of optimum moisture content in accordance with ASTM D1557.

1. Main and Lateral Line Sleeving:
   a. Install under all paved surfaces as indicated on the Drawings.
   b. Minimum depth to top of pipe shall be determined by depth of mainline and lateral lines.
   c. Lay sleeve to drain at minimum grade of 3"/100'. Cut squarely with tubing cutter, hand saw or hack saw and remove burrs.
   d. Ends of Sleeves: Mark in manner to ensure easy location in future. Do not allow sleeves to become filled with soil or other undesirable material.
   e. Install valve control wire in separate sleeve inside of mainline sleeve.
2. Electrical Sleeving:

a. Controller: Provide sleeve from controller box or enclosure to nearest mainline pipe. Provide below grade sweeps or changes in direction of no less than twenty-four inch (24") radius bends.
b. Install sleeve at the mainline depth.

C. Trenching: Trench excavation shall follow, as much as possible, layout shown on Drawing. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed.
1. Trenching Under Limb Spread of Existing Trees: Accomplish by hand or other method that will not damage limbs or branches. Keep trenching at least six feet (6'-0") from trunk of existing trees and shrubs. Coordinate with landscape installation.
2. Trenching Location: The Contractor shall be responsible for contacting the respective utility companies five (5) days in advance of excavation and verifying the exact locations of all utilities. The indication of the utilities on the Drawings does not relieve the Contractor of the responsibility for utility location. Trenches shall be routed to avoid existing utilities. Verify with the Architect any required relocation prior to installation.
3. Clearances:
   a. Piping 3" and Larger: Make trenches of sufficient width (14" minimum) to properly assemble and position pipe in trench. Minimum clearance of piping three inches (3") or larger shall be five inches (5") horizontally on both sides of the trench.
   b. Piping Smaller than 3": Trenches shall have a minimum width of seven inches (7").
   c. Line Clearance: Provide not less than six inches (6") of clearance between each line, and not less than twelve inches (12") of clearance between lines of other trades. Do not stack pipe in trench.
4. Pipe and Wire Depth:
   Pressure Supply Piping: 24" from top of pipe.
   Non-pressure Piping (rotor): 16" from top of pipe.
   Non-pressure Piping (pop-up): 10" from top of pipe.
   Control Wiring: Side of pressure main.
   Drip Tubing: 10" from top of pipe.
   Emitter Tubing (Micro-tubing): under mulch..
5. Boring will be permitted only where pipe must pass under obstruction(s) which cannot be removed. In backfilling bore, final density of backfill shall match that of surrounding soil. It is acceptable to use sleeves of suitable diameter installed first by jacking or boring, and pipe laid through sleeves. Observe same precautions as though pipe were installed in open trench.
6. Vibratory Plow: Non-pressure piping may be installed through use of vibratory plow method if consultant determines soil conditions are satisfactory for this method installation. Vibratory plowing does not relieve installer of minimum pipe depths.

D. Backfilling:
1. Excavated trenching material will generally be considered satisfactory for backfill purposes. Backfill material shall be free from rubbish, vegetable matter, frozen materials, or stones larger than one inch (1") in maximum dimension. Do not mix subsoil with topsoil. Haul away any material not suitable for backfill. Contractor shall be responsible for providing suitable backfill if excavated material is unacceptable or not sufficient to meet backfill, compaction and final grade requirements.
2. Do not backfill in freezing weather except with written approval from the Architect.
3. Compact to existing densities.
4. Leave backfill in trenches slightly mounded to allow for settling.
5. Trenches shall be finished graded prior to walk-through of system with Architect and Owner.
6. Do not leave trenches open for more than forty-eight (48) hours. Open excavations shall be protected in accordance with OSHA regulations.

7. Compact backfill to ninety percent (90%) maximum density, determined in accordance with ASTM D155-7 utilizing the following methods:
   a. Mechanical tamping.
   b. Puddling or ponding: Puddling or ponding and/ or jetting is prohibited within twenty feet (20') of building or foundation walls.

3.03 INSTALLATION

A. PVC Piping: Snake pipe in trench as much as possible to allow for expansion and contraction. Do not install pipe when air temperature is below forty (40) degrees F. Place manual drain valves at low points and dead ends of pressure supply piping to insure complete drainage of system. When pipe laying is not in progress, or at end of each day, close pipe ends with tight plug or cap. Perform work in accordance with good practices prevailing in piping trades.

B. PVC Pipe:
   1. Solvent Weld Pipe: Use primer and solvent cement. Lay pipe and make all plastic to plastic joints in accordance with Manufacturer's recommendations. Cure for 30 minutes (minimum) before handling and 24 hours before allowing water in pipe.
   2. Rubber Gasketed Pipe: Use pipe lubricant. Join pipe in the manner recommended by the Manufacturer and in accordance with accepted industry practices.

C. Drip Tubing:
   1. Make all fitting connections as per Manufacturers recommendations.
   2. Use only Manufacturer provided or recommended hole punch when making penetrations in drip tubing for insert fittings. Use of any other hole punch shall be cause for immediate removal and replacement of all installed drip tubing.
   3. Install drip line blow-out stubs at all dead ends of drip tubing.

D. Control Wiring:
   1. Low voltage wiring:
      a. Bury control wiring between controller and electric valves in pressure supply line trenches, strung as close as possible to main pipe lines with such wires to be consistently located below and to one side of pipe, or in separate trenches.
      b. Tape all twenty-four (24) volt wires at ten foot (10') intervals and lay with pressure supply line pipe to one side of the trench, consistently located below and to one side of the pipe.
      c. Provide an expansion loop at every pressure pipe angle fitting, every electric control valve location (in valve box), and every one hundred feet (100'). Form expansion loop by wrapping wire at least eight (8) times around a three quarter inch (3/4") pipe and withdrawing pipe. Electrical connection at valve should have sufficient slack to allow ends to be pulled twelve inches (12") above ground for examination and cleaning.
      d. Make all splices and E.C.V. connections using Rainbird Pentite connectors or similar dry splice method.
      e. Install all control wire splices not occurring at control valve in a separate splice valve box.
      f. Install one control wire for each control valve.
      g. Run spare control wires and one (1) common wire from controller pedestal to the end of each and every leg of mainline. Label spare wires at controller and wire stub box. See Drawings for extra wire requirements.
      h. Make connections in accordance with NEC.
      i. Connect electric control valves to controller in numerical sequence as shown on the Drawings.
   2. High voltage wiring for automatic controller:
      a. Provide one-hundred twenty (120) volt power connection to automatic controller. (by Town)

b. All electric work shall conform to local codes, ordinances, and authorities having jurisdiction. All high voltage electrical work shall be performed by licensed electrician.

E. Automatic Controller:
1. Install controller in accordance with Manufacturer's published instructions.
2. Final location of controller shall be approved by Architect and Town maintenance/grounds personnel, prior to installation.
3. Controller shall have a dedicated separate ground wire and grounding rod as recommended by the Manufacturer.
4. All above ground conduit shall be rigid galvanized with appropriate fittings. All below ground conduit shall be Schedule 40 PVC.

F. Electric Control Valves:
1. Mount in-line with threaded connections. Flow control handle shall be a minimum of three inches (3") below finish grade where shown on the Drawings and as detailed.
2. Install valves in separate valve boxes, a minimum of twelve inches (12") apart. Provide vertical separation to prevent contact with the mainline.
3. When grouped together, allow at least twenty-four inches (24") minimum between valve box sides.
4. Install Mirafi 104N or equal at bottom of electric control valve, valve box. Turn up fabric minimum four inches (4") around outside of valve box body prior to backfill. Stretch fabric taut at bottom of valve box. Install minimum four inches (4") gravel sump over fabric in bottom of each valve box.
5. Install individual valve boxes flush with finish grade. Rectangular valve boxes to be set at parallel lines to adjacent site or architectural features. Multiple box locations shall all align uniformly.
6. Each valve shall be identified by permanently affixing a brass tag to the flow control stem showing controller number.
7. Brand controller letter and station number on lid of each valve box. Letter and number size shall be no smaller than one inch (1") and no greater in size then one and one-half inches (1½"). Depth of branding shall be no more than one-eighth inch (1/8") into valve box lid.
8. Identify additional/spare wires on 'as-built' documents.

G. Quick Coupling Valves:
1. Install quick couples on swing-joint assemblies of Schedule 80 PVC pipe; plumb and flush to grade.
2. Angled nipple relative to pressure supply line shall be no more than forty five (45) degrees and no less than twenty (20) degrees.
3. Install quick coupling valves a detailed and in separate valve boxes.

H. Drip Valve Assemblies:
1. Install drip valve assembly as detailed.

I. Drip Emitters:
1. Stake all surface emitters as detailed and staked with acceptable tubing stakes as required.
2. Provide two (2) one gallon per hour emitters for each shrub and four (4) two gallon per hour emitters for each tree.

J. Manual Drain Valves:
1. Install manual drain valves at all low points in pressure supply line as detailed.
2. Provide a three (3) cubic foot gravel drainage sump for each drain valve.

K. Valve Boxes:
1. Install one (1) valve box for each type of valve installed as detailed.
2. Valve box extensions are not acceptable except for master valves.
3. Install gravel sump after compaction of all trenches.
4. Place final portion of gravel inside valve box after valve box is backfilled and compacted.

L. Isolation Gate Valves:
1. Compact subgrade to insure no settling occurs.
2. Install concrete thrust blocks on either side of valves.
3. Install in valve box with extensions to depth of valve.
4. Install where shown on Drawings as detailed, and locate at least twelve inches (12") from and align with adjacent walls or edges of pavement.

M. Sprinkler Heads:
1. Install where designated on the Drawings.
2. Set heads plumb and one and one-half inches (1½") above finish earth grade in sod areas and flush with grade in seeded areas, except where part circles sprinklers are adjacent to curbs or paved surfaces where they should be set at the elevation of the curb or paved surface. Install heads six inches (6") away from adjacent pavement and twelve inches (12") away from building.
3. Install heads on swing-joint risers of Schedule 40 PVC pipe. Angled nipple, relative to non-pressure line, shall be no more than forty-five (45) degrees or less than twenty (20) degrees.
4. Spacing of heads shall not exceed the maximum indicated on the Drawing. In no case shall the spacing exceed maximum recommended by the Manufacturer.
5. Adjust heads for proper coverage.
6. No plant placement shall interfere with intended sprinkler head coverage, piping or other equipment.
7. Architect may request nozzle changes or adjustments without additional cost to the Owner.

N. Air Vacuum Relief Valve: Install in valve box per detail.

O. Piping Under Paving:
1. Provide for a minimum cover of eighteen inches (18") between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete or concrete paving.
2. Piping located under areas where asphalt or concrete paving will be installed shall be bedded with sand (a layer six inches (6") below pipe and six inches (6") above pipe).
3. Compact backfill material in six inch (6") lifts at ninety percent (90%) maximum density determined in accordance with ASTM D155-7 using manual or mechanical tamping devices.
4. Set in place, cap, and pressure test all piping under paving, in presence of Architect prior to backfilling and paving operations.
5. Piping under existing walks or concrete pavement shall be done by jacking, boring, or hydraulic driving, but where cutting or breaking of walks and/ or concrete is necessary, it shall be done and replaced at no cost to Owner. Obtain permission to cut or break walks and/ or concrete from Owner.

P. Water Supply and Point of Connection: Water supply shall be extended as shown on the Drawing from water supply lines. Coordinate with civil drawings as necessary.

3.04 PRECISE EQUIPMENT LOCATION

A. Edge of sprinkler equipment exposed at grade level shall be placed two inches (2") away from adjacent pavements and walls unless otherwise indicated. Locate other equipment as near as possible to the location indicated. Dimensioned pipe routing or equipment locations may not deviate from their indicated positions. Deviations must be accepted by the Architect prior to installation.

3.05 FLUSHING

A. Flushing: After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, quick coupler assemblies, and hose valves, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for five (5) minutes through furthermost valves. Cap risers after flushing.

B. Nozzle Changes: Architect may require nozzle changes as deemed appropriate for coverage with no additional cost incurred to the Owner. Change out nozzles as directed accordingly.

3.06 ADJUSTING

A. Upon completion of installation, "fine-tune" entire system by regulating valves adjusting patterns and break-up arms, setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage. Flush and adjust all sprinkler heads for optimum performance and to prevent over spray onto walks, roadways, and buildings as much as possible. Heads of same type shall be operating at same pressure +/- 7%.

1. If it is determined that irrigation adjustments will provide proper coverage, and improved water distribution as determined by the Architect, Contractor shall make such adjustments prior to Final Acceptance, as directed, at no additional cost to Owner. Adjustments may also include changes in nozzle sizes, degrees of arc and control valve throttling.
2. All sprinkler heads shall be set perpendicular to finish grade unless otherwise designated.
3. Areas which do not conform to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the Owner.

3.07 COMPLETION SERVICES

A. Walk-through for Substantial Completion:

1. Arrange for the Architect's presence forty-eight (48) hours in advance of walk-through.
2. Entire system shall be completely installed and operational prior to scheduling of walk-through.
3. Operate each zone in its entirety for the Architect at time of walk-through and additionally, open all valve boxes if directed.
4. Generate a list of items to be corrected prior to Final Completion.
5. Furnish all materials and perform all work required to correct all inadequacies of coverage due to deviations from Contract Documents.
6. During walk-through, expose all drip emitters under operations for observation by the Architect to demonstrate that they are performing and installed as designed, prior to placing of all mulch material. Schedule separate walk-through if necessary.

B. Walk-through for Final Completion:

1. Arrange for the Architect's presence forty-eight (48) hours in advance of walk-through.
2. Show evidence to the Architect that the Owner has received all accessories, charts, record drawings and equipment as required before final completion walk-through is scheduled.
3. Operate each zone, in its entirety for the Architect at time of walk-through to insure correction of all incomplete items.
4. Items deemed not acceptable by the Architect shall be reworked to complete satisfaction of the Architect.

5. If after request to the Architect for walk-through for final completion of irrigation system, the Architect finds items during walk-through which have not been properly adjusted, reworked, or replaced as indicated on list of incomplete items from previous walk-through, Contractor shall be charged for all subsequent walk-thru's. Funds will be withheld from final payment and/ or retainage to Contractor, in amount equal to additional time and expenses required by the Architect to conduct and document further walk-thru's as deemed necessary to insure compliance with Contract Documents.

C. Project Record (As-built Drawings):

1. A contract set of Drawings for all phases of the work shall be maintained at the site, with all changes or deviations from the original Drawings marked thereon in contrasting color. This shall be a separate set of Drawings, not used for construction purposes, which will be kept up to date as the job progresses and be made available to the Architect for inspection at all times. The Contractor shall revise a tracing of the design Drawings to indicate all changes made during installation. Mylars or CAD data files compatible with AutoCAD software, will be available from the Architect. Using technical drafting pen or CAD, duplicate information contained on the contract set of drawings maintained on site. Label each sheet "Record Drawing". Dimensions, from two (2) permanent points of reference (building corners, sidewalk, road intersections or permanent structures), for the location of following items:
   a. Connection to existing water lines.
   b. Routing of sprinkler pressure lines (dimension maximum one-hundred feet (100') along routing).
   c. Sprinkler control valves.
   d. Quick coupling valves.
   e. Drain valves.
   f. Drip line blow-out stubs.
   g. Control wire routing if not with pressure mainline.
   h. All gate valves.
   i. Other related equipment as directed.

2. Turn over the "Record Drawings" to the Architect. Completion of the Record Drawings will be a prerequisite for the Review at the completion of the irrigation system installation.
3. Operation and Maintenance Manual: Submit three (3) bound brochures including:
   a. Written operating instructions including spring start-up and winterization procedures.
   b. Controller programming schedule indicating length of time each zone is to be operated. Calculate turf zones at one and one half inches (1½") of water per week. Coordinate controller/ watering operations with Owner's maintenance personnel.
   c. Controller Charts:
      1) Do not prepare charts until record (as-built) drawings have been reviewed by the Architect.
      2) Provide one (1) controller chart for each automatic controller installed.
         a) Chart may be reproduction of record drawing, if scale permits fitting of controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
         b) Chart shall be blueline print of actual "as-built" system, showing area covered by that controller.
      3) Identify area of coverage of each remote control valve, using a distinctly different color drawing over entire area of coverage.
      4) Following review of charts by Architect they shall be hermetically sealed between two (2) layers of twenty millimeter (20 mm) thick plastic sheet.
      5) Charts shall be completed and reviewed prior to final review of irrigation system.

4. EXTRA MATERIALS

1) In addition to installed system furnish the following items to Owner:
   a. Five (5) pop-up spray heads with nozzles of each type used.
   b. Four (4) rotor heads of each type used.
   c. Thirty (30) drip emitters of each type used.
2) Furnish the following maintenance items to Owner prior to Final Acceptance:
   a. Two (2) sets of special tools required for removing, disassembling, and adjusting each type of sprinkler head and valve supplied on this project.
   b. Two (2) six foot (6') valve keys for operation of gate valves or stop and waste valves (if applicable).
   c. Two (2) keys for each automatic controller and enclosure.
   d. Four (4) quick coupler keys and two (2) matching hose swivels for each type of quick coupling valve installed.
   e. Two (2) aluminum drain valve keys of sufficient length for operation of drain valves.

3.08 WINTERIZATION AND SPRING START-UP

A. Winterization: At the end of the first irrigation season, within three (3) days of notification of the Owner, drain the system and connect an air compressor of sufficient size to discharge all water from low points of the system. Coordinate the winterization with the landscape maintenance personnel.

B. Spring Start-up: Recharge, operate and adjust system malfunctions at the start of the next irrigation season within three (3) days of notification by the Owner. Coordinate the start-up with the landscape maintenance personnel.

3.09 MAINTENANCE

A. Upon completion of construction and review by the Architect, maintain the irrigation system for a duration of thirty (30) calendar days. Make periodic examinations and adjustments to the irrigation system components to achieve the most desirable application of water.

B. Following the completion of the Contractor's maintenance period, the Owner will be responsible for maintaining the system in working order during the remainder of the warranty/guarantee period, for performing necessary minor maintenance and for protecting against vandalism.

3.10 DEMONSTRATIONS

A. Demonstrations: Demonstrate system to the Owner's personnel. Include proper operation of system, adjusting of sprinkler heads, valves, controller and winterization procedures.

3.11 CLEANING

A. Clean-up: Continuous operation throughout the duration of the work. Remove rubbish from site on daily basis. Deposit all excavated materials at least twenty-four inches (24") away from any trench side and promptly haul away any excess material leaving the backfilled trench with a neat and workmanlike appearance to the satisfaction of the Architect. Any material not removed may be removed by Owner at Contractor's expense with a minimum advance notice of five (5) working days.

END OF SECTION

# SECTION 02910
# TOPSOIL, FINE GRADING AND SOIL PREPARATION

## PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Salvaging Existing Topsoil for Re-distribution.
   2. Ripping/disking.
   3. Spreading stockpiled Topsoil.
   4. Soil Conditioner
   5. Fine Grading.

B. Related Sections:
   1. Earthwork: Section 02300.
   2. Seeding: Section 02921.

1.02 SUBMITTALS

A. Quality Control Submittals:
   1. Certificates: State, federal and other inspection certificates shall accompany invoice for materials showing source or origin. Submit to Architect prior to acceptance of material.

1.03 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Section 01600.

B. Soil Amendments: Not Required

1.04 PROJECT/SITE CONDITIONS

A. General: Do not perform work when climate and existing site conditions will not provide satisfactory results.

B. Vehicular accessibility on site shall be as required. Repair damage to prepared ground and surfaces caused by vehicular movement during work under this Section to original condition at no additional cost to Owner.

## PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Topsoil:
   1. Existing Topsoil: This material is considered adequate for reuse as topsoil. Four (4) inches of existing topsoil shall be stripped and stockpiled for reuse and spreading.

B. Soil Conditioner: Per notes on drawing.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. General: Verify that existing site conditions are as specified and indicated before beginning work under this Section.

1. Grades: Inspect to verify rough grading is within +/- 1.25" of grades indicated and specified.
2. Damaged Earth: Inspect to verify that earth rendered unfit to receive planting due to concrete water, mortar, lime water or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Architect. All access roadways or compacted soil shall be ripped to loosen.

B. Unsatisfactory Conditions: Report in writing to General Contractor with copy to Architect.

C. Acceptance: Beginning of installation means acceptance of existing conditions by Contractor.

3.02 PREPARATION

A. Protection:
1. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment prior to commencing work.
2. Be responsible for proper repair to landscape, utilities, walls, pavements and other site improvements damaged by operations under this Section.
3. Pay for repairs made by Contractor(s) designated by Owner.

B. Weed Control: Remove annual weeds by tilling. Remove perennial weeds by applying herbicide one (1) week before soil preparation and as needed, but no sooner than three (3) months after emergence. Do not use Herbicide within 200 feet of any water body. Contractor to keep a log of all herbicide application rates throughout the duration of the project detailing its application and submit to Owner at the completion of project as required.

C. Surface Grade: Remove existing grass, weeds, debris and rocks larger than three quarters of an inch (3/4") in all areas designated to receive new bluegrass sod or bluegrass seed. Verify that all rough grades have been established in accordance with specified earthwork grade tolerances and other provisions.

D. Runoff: Take measures and furnish equipment and labor necessary to control the flow, drainage, and accumulation of water to run off the grounds as is intended by the grades.

E. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion (see Section 02921), blowing soil and accumulation of wind-deposited material on the site throughout duration of work.

3.03 INSTALLATION

A. Ripping and Tilling: Rip/till to minimum of eight inches (8"), with agricultural sub-soiler, in all areas to receive bluegrass sod with four (4) passes in at least two (2) directions. Rip/till to minimum of four inches (4"), with agricultural sub-soiler in native seed areas, with four (4) passes in at least two (2) directions. In areas where extremely stiff material or debris is encountered during ripping, re-adjust equipment to avoid bringing up chunks of un-tillable material.

B. Topsoil:

1. Apply four inches (4") deep (when compacted to eighty percent (80%) density with two percent (2%) at optimum moisture content) of stockpiled topsoil over entire disturbed area to receive landscaping.
2. Imported topsoil not required unless existing is deemed to be unusable.

C. Soil Conditioner: Per Notes on plan.

D. Fertilizer:
1. See Part 2, C. of this Section.

E. Fine Grading in seeded areas:
1. Do fine grading for areas prior to native seeding.
2. For ground surface areas surrounding buildings, maintain required positive drainage away from buildings as required by Soils Engineer/Report.
3. Noxious weeds or parts thereof shall not be present in the surface grade prior to seeding.
4. Prior to acceptance of grades, hand rake to smooth, even surface free of debris, clods, rocks and vegetable matter greater than three quarters of a inch (3/4").

3.04 NOTIFICATION AND INSPECTION

A. Inspection: Provide notice to Landscape Architect requesting inspection at least seven (7) days prior to anticipated date of completion.

B. Deficiencies: Landscape Architect will specify deficiencies to Contractor who shall make satisfactory adjustments and shall again notify Architect for final inspection.

3.05 CLEANING

A. General: Remove debris and excess materials from site. Clean out drainage inlet structures as required. Clean paved and finished surfaces soiled as a result of work under this Section, in accordance with direction given by Architect.

3.06 PROTECTION

A. General: Provide and install barriers as required and as directed by Architect to protect completed areas against damage from pedestrian and vehicular traffic until acceptance by Owner. Contractor is responsible for malicious destruction caused by others.

**END OF SECTION**

# SECTION 02921
# SEEDING

## PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. 'Native Seed Mix.
   2. Hydromulch.
   3. Erosion Control Matting.
   4. Maintenance.

B. Related Sections:
   1. Topsoil, Fine Grading and Soil Preparation: Section 02910.
   2. Sodding: Section 02923.
   3. Trees, Shrubs and Groundcover: Section 02930.

1.02 REFERENCES

A. Reference Standards: Comply with U. S. Department of Agriculture Rules and Regulations under Federal Seed Act and be equal in quality to standards for Certified Seed.

1.03 SUBMITTALS

A. Quality Control Submittals:
   1. Certificates: State, federal or other inspection certificates shall accompany the invoice for materials showing source or origin. Submit to Architect prior to acceptance of the material.
   2. A sample of the soil retention blanket shall be submitted at least two (2) weeks in advance of its use on the project for approval by the Architect. Blankets that utilize plastic retainers will be rejected.

B. Contract Closeout Submittals:
   1. Operating and Maintenance Data: At completion of work, submit three (3) copies. Include directions for irrigation, aeration, mowing, fertilizing and spraying as required for continued and proper maintenance through full growing season and dormant period.

C. Warranty: At completion of work, furnish written warranty to Architect based upon requirements as specified.

1.04 QUALITY ASSURANCE

A. Source Quality Control:
   1. Seed Materials: Subject to inspection and acceptance. Architect reserves the right to reject at any time or place prior to acceptance, any work and seed which in Architect's opinion fails to meet Specification requirements.
   2. Inspection: Primarily for quality, however, other requirements are not waived even though visual inspection results in acceptance.
   3. Inspection can be made periodically during seeding, at completion and at end of warranty period by Architect.

B. Testing Requirements: Seed and seed labels shall conform to current State and Federal regulations and be subject to testing provisions of the Association of Official Seed Analysis.

1.05 DELIVERY, STORAGE AND HANDLING

A. Seed: Deliver seed in sealed standard containers stating correct name and composition on the outside of the container. Seed damaged in transit or storage will not be accepted.

B. Notification: Verify material arrivals at project site with Architect. Immediately remove unacceptable material from job site.

1.06 PROJECT/SITE CONDITIONS

A. Existing Conditions:

1. Vehicular accessibility onsite shall be as directed by Architect. Repair damage to prepared ground and surfaces caused by vehicular movement during work under this Section to original condition at no additional cost to Owner.

B. Environmental Conditions: Do not drill or sow seed during windy weather or when ground is frozen or otherwise un-tillable.

1.07 WARRANTY

A. Warranty for 'Native Grass Seed Areas: Warrant areas in seed to be in a healthy, vigorous growing condition and for consistency of coverage for a period of one (1) year from date of acceptance. After time of seed germination, re-seed any spots where seed has not germinated within the total seeding area. Continue this procedure until a successful stand of grass is growing and accepted by the Architect and Owner.

1.08 MAINTENANCE

A. General: The maintenance period shall begin immediately after each area is seeded and continue until final acceptance of entire project. During this time, be responsible for all work as necessary to ensure that seeded areas are in a vigorous growing condition. Provide all supervision, labor, material and equipment to maintain seeded areas.

B. Materials: Conform to Specifications or otherwise be acceptable to the Architect.

C. Watering: Not required for native seed areas.

D. Weed Control: As required, using selective herbicides approved by Architect and adhering to local environmental laws. Do not use herbicides within 200 feet of any water body.

E. Insect and Disease Control: As required, apply insecticide and fungicide approved by Architect and adhering to local environmental laws.

F. Reseeding: In areas larger than one (1) sq. ft. in which no stand of grass is established. Reseed and water until stand of grass is successfully established.

G. Mowing and Trimming:

1. Mow non-irrigated, native grasses only as required. Cut back to six inches (6"). This shall occur no more than three (3) times only during the first year. Remove clippings from adjacent gravel, pavement or irrigated turf areas.

H. Fertilization:
1. 'Native Seed Mix' - None required.

## PART 2 - PRODUCTS

2.01 MATERIALS

A. Seed Mixtures:
1. Seed Mixture for Seeding Areas as Indicated:

Sow the following seed mixture(s) for pure live seed at the following rate(s):

a. Native Seed Mix – Use mix on plans if seeded between February-May 1st. If seeding is done outside this window consult the Landscape Architect for Alternate Mixes such as Annual Rye Grass.

B. Water: Free of substances harmful to plant growth. Owner is responsible for watering seeded areas for one (1) full year from date of seeding.

C. Fertilizer: Apply in accordance with Section 02910 – Topsoil, Fine Grading and Soil Preparation.

D. Mulch:
1. Seeded Areas: Hydromulch with Conweb 200/Matfiber and Tackifier or accepted substitute.
a. Wood cellulose fiber: Must be thermally produced, air dried and conforming to the following:

Percent Moisture Content: 12.0% ± 3.0%.
Percent Organic Matter: 99.3% minimum.
Percent Ash: 0.8% ± 0.2%.
pH Range: 4.8% ± 0.5%.
Percent Water Holding Capacity: 100 gms. H20/100 gms. Fiber.
Water Soluble Dye: Green.

b. Mulch Material: Supply in packages having gross weight not over one-hundred pounds (100 lbs.) and marked by Manufacturer to show air dry weight content.
c. Tackifier: Hydromulch fiber may contain tackifier or tackifier may be added at time of mulching.
d. Suppliers: Certify that laboratory and field testing of product has been accomplished and that it meets all of foregoing requirements for wood cellulose fiber mulch. Inorganic tackifier and asphaltic material will not be permitted. The organic tackifier shall be a free-flowing, non-corrosive powder produced from natural plant gum of Plantago Insulares (Indian Wheat) and applied at a minimum rate of one-hundred pounds (100 lbs.) per acre.

E. Erosion Control: Shall be a machine produced mat consisting of seventy percent (70%) agricultural straw and thirty percent (30%) coconut fiber. The blanket shall be of consistent thickness with the straw evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with polypropylene netting having an approximate 16 mm x 16 mm mesh and on the bottom with polypropylene netting with an approximate 6 mm x 6 mm to 13 mm x 13 mm mesh. The blanket shall be sown together with cotton, biodegradable thread. Blankets utilizing plastic thread will be rejected.

F. Staples: No. 11 gauge steel wire formed into a "U" shape six inch (6") long.

## PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions are as specified and indicated before beginning work under this Section.
   1. Layout: Verify layout of seeding areas as indicated prior to starting seeding operations.
   2. Grades: Verify intent of Drainage Channels and relationship of adjacent grades, modified grades and desired clean-up and drainage results.

B. Acceptance: Beginning of installation means acceptance of existing conditions by Contractor.

3.02 PREPARATION

A. Protection:
   1. Be responsible for proper repair to landscape, utilities, walls, pavements and other site improvements damaged by operations under this Section.
   2. Pay for repairs made by Contractor(s) designated by Architect.
   3. Identify prepared seeding areas requiring protection and erect barriers for proper protection and traffic control maintained throughout germination/development period.

B. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited materials on the site throughout the duration of work. Erosion damage is the Contractor's responsibility once site disruption begins.

C. Drainage Channels: Entire channel flow lines, banks and adjacent terrain within fifteen feet (15') of channel center lines are to be cleared and re-vegetated with seed.

D. Seeded Areas: Remove weeds, debris and rocks larger than three quarters of an inch 3/4") which may hinder seeding or subsequent operations. Dispose of accumulated debris at direction of Architect.

E. Fine Grading: Perform as required to maintain positive drainage, prevent ponding while directing run-off into catch basins, drainage structures, etc. and as required to provide

smooth uniform, well-contoured surface prior to proceeding. Tolerance: ± one half inch (½").

3.03 SEEDING

A. General: Seed in manner such that after surface is raked and rolled, seed shall have one-quarter inch (¼") of cover.

B. Hydraulic Seeding/Mulching Equipment: Include pump capable of being operated at one-hundred (100) gallons per minute and at one-hundred pounds (100 lbs.) per square inch pressure, unless otherwise directed.
   1. Equipment: Nozzle adaptable to hydraulic seeding requirements.
   2. Storage Tanks: Means of estimating volume used or remaining in tank.

C. Drainage Channels: Seed all drainage channels and other areas of potentially high flows at two (2) times the specified rate.

3.04 MULCHING

A. Hydromulching:
   1. Mixing: Add cellulose fiber mulch after proportionate quantities of water and other accepted material have been placed in slurry tank. Mix ingredients to form homogeneous slurry.
   2. Spraying: Spray apply slurry mulch uniformly over designated seed areas using color of mulch as metering agent.
      a. Apply at rate of two thousand pounds (2,000 lbs.) per acre plus tackifier at rate of one-hundred pounds (100 lbs.) per acre.
   3. Hydromulching: Do not apply in presence of free surface water resulting from rain, melting snow or other causes.

B. Timing: Mulch seeded areas within twenty four (24) hours after seeding. Areas not mulched within twenty four (24) hours after seeding shall be re-seeded with the specified seed mix prior to mulching.

C. Hay Mulching: If utilized, it must be crimped into the soil.

D. Quality Control: Repair and re-mulch areas improperly mulched or damaged by Contractor's negligence, in specified manner. Mulch removed by circumstances beyond the Contractor's control shall be repaired and re-mulched as ordered with payment for this corrective work, when ordered, at the contract prices.

3.05 EROSION CONTROL **(to be utilized on all slopes 4:1 or steeper)**

A. Soil Retention Blankets: The area to be covered with Soil Retention Blanket shall be properly prepared and seeded before the blanket is placed. When the blanket is unrolled, the heavyweight jute netting shall be on top and the lightweight jute netting shall be in contact with the soil. In ditches and on slopes, blankets shall be unrolled in the direction of the flow of water. Installation shall be in accordance with the Manufacturer's recommendations. A representative of the Manufacturer can be present to give instruction during the installation of the soil retention blanket.
   1. The blanket shall be placed smoothly but loosely on the soil surface without stretching.
   2. The upslope end shall be buried in a trench six inches (6") wide by six inches (6") deep beyond the crest of the slope to avoid undercutting. For slope applications,

there shall be a six inches (6") overlap wherever one (1) roll of blanket ends and another begins with the uphill blanket placed on top of the blanket on the downhill side.

3. There shall be a four inch (4") overlap whenever two (2) widths of blanket are applied side to side.
4. Insert staples in a pattern according to the Manufacturer's recommendation at approximately two (2) staples per square meter.
5. At terminal ends and every twenty-five feet (25'). Soil Retention Blanket placed in ditches shall be buried in a trench approximately 6" deep by 6" wide. Before backfilling, staples shall be placed across the width of the trench spaced at 6" on center in a zigzag pattern. The trench shall then be backfilled to grade and compacted by foot tamping.

B. Drainage Channels:
1. Grade and smooth channel. Apply seed prior to installing blankets.
2. Anchor blankets at top of channel. Backfill with check slot material. For culvert outfalls, place blanket at least twelve inches (12") upstream from pipe opening.
3. Install a blanket in the center of the channel, in the direction of water flow. Additional blankets are installed at the edges of this center blanket.
4. Construct check slots with soil, gravel, or stone, in the middle and end of each blanket.
5. Overlap side channel blanket edges a minimum of three inches (3") over the center channel blanket and staple. Overlap end and beginning blanket edges a minimum of six inches (6") and staple.
6. Anchor the top edge of side channel blankets.
7. Anchor the terminal ends of blankets in a check slot.

C. Stapling: Staple overlaps which run parallel to direction of flow in channel bottoms on two foot (2') intervals. Staple outside edges, centers and overlaps on banks on two foot (2') intervals.
1. Each Width of Cloth: Install row of staples down center as well as along each side.
2. Staple check slots and junctions of new rolls across channel on six inch (6") intervals.
3. On soft or sandy soil or in windy areas, apply staples in alternate slanting position and space at eighteen inch (18") intervals.
4. For extra hard soil or shale areas, use sharp hardened steel three inch (3") fence type staples.

3.06 NOTIFICATION AND INSPECTION

A. Inspection: Provide notice to Architect requesting inspection at least seven (7) days prior to anticipated date of completion. All planting must be alive and healthy in order to be considered complete.

B. Deficiencies: Architect will specify deficiencies to Contractor who shall make satisfactory adjustments and shall again notify Architect for final inspection.

3.07 CLEANING

A. Remove debris and excess materials from site. Clean paved and finished areas soiled as a result of work under this Section, in accordance with direction given by Architect. Clean out drainage inlet structures as required.

B. Remove mulch immediately from trees, shrubs and sod to prevent damage to same.

3.08 PROTECTION

A. Provide and install barriers as required and as directed by Architect to protect seeded areas from damage from pedestrian and vehicular traffic. Contractor is responsible for malicious destruction of seeding caused by others.

**END OF SECTION**